Dec. 22, 1942. G. W. DRYSDALE 2,305,850

BENDING MACHINE

Filed May 27, 1940 3 Sheets-Sheet 1

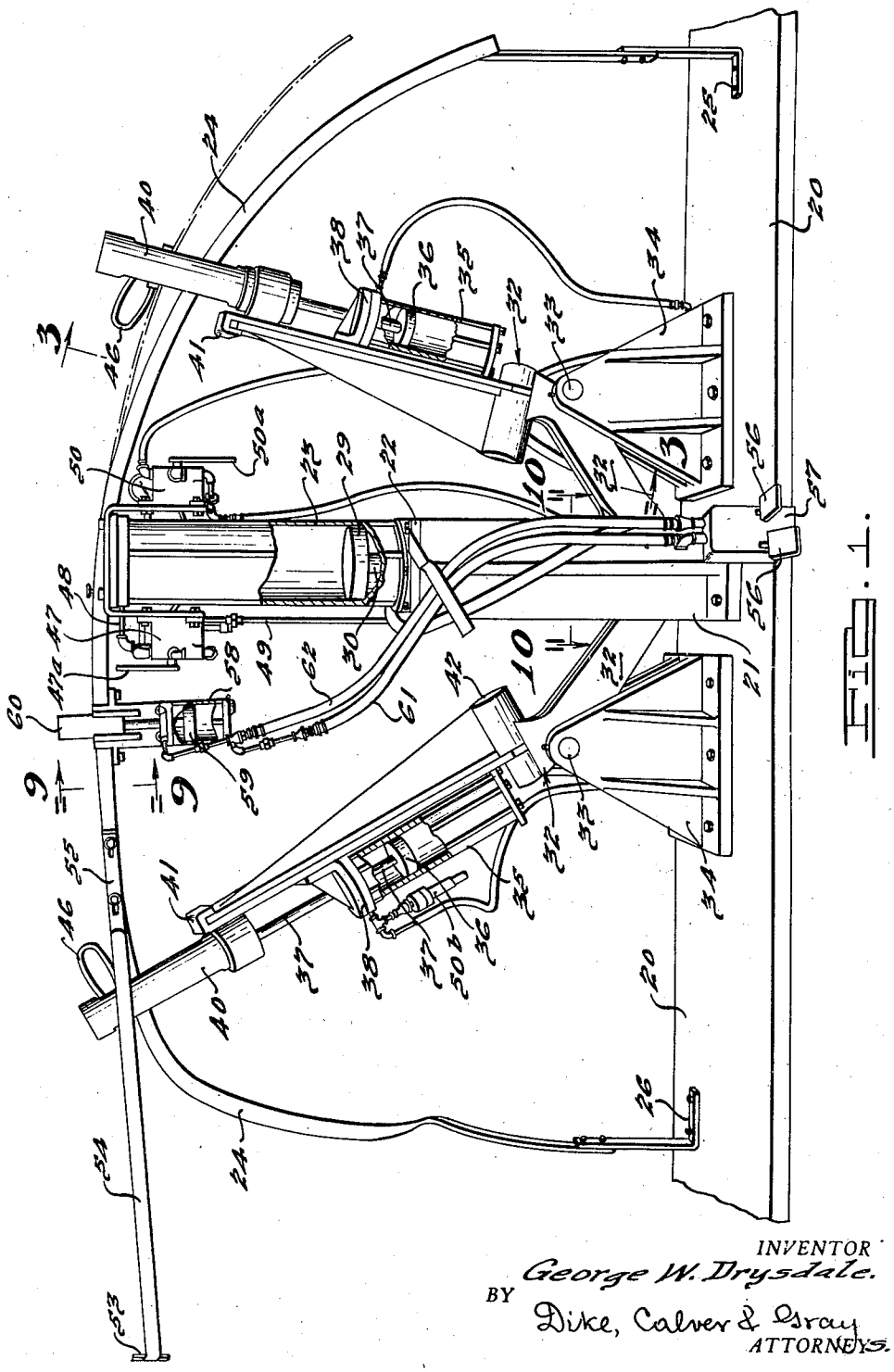


FIG. 1.

INVENTOR
George W. Drysdale.
BY
Dike, Calver & Gray
ATTORNEYS.

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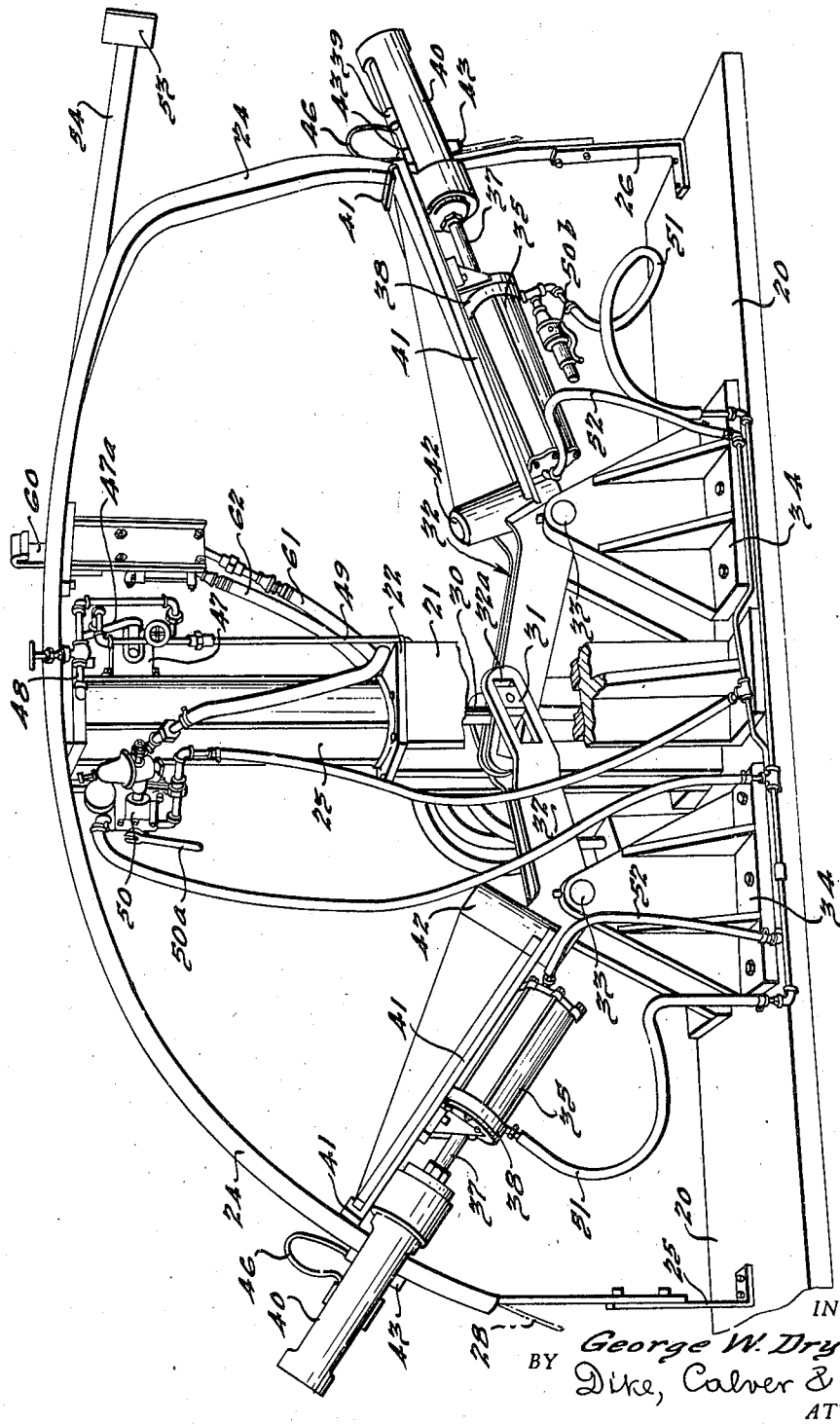


Fig. 2.

INVENTOR
George W. Drysdale.
BY Dike, Calver & Gray
ATTORNEYS.

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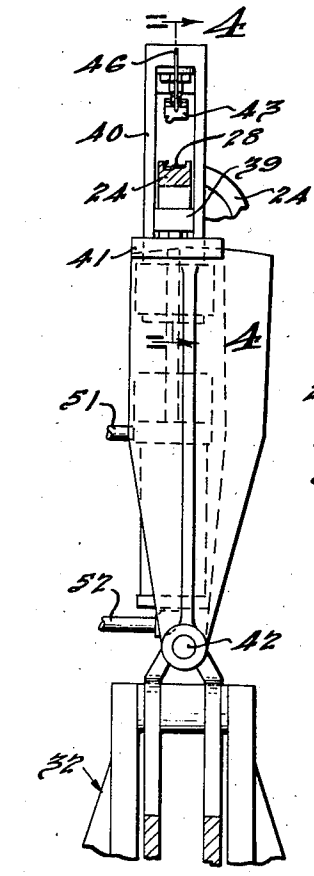


Fig. 3.

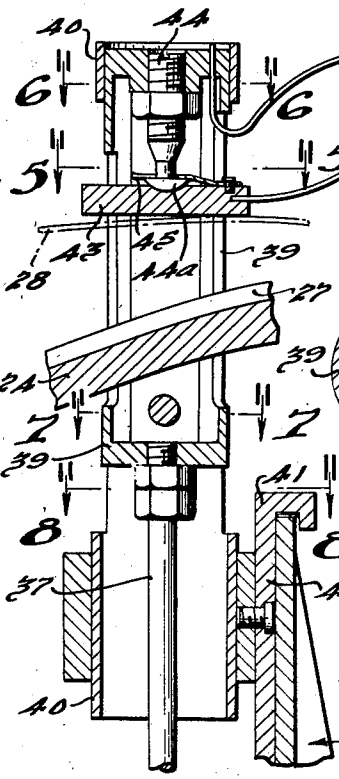


Fig. 4.

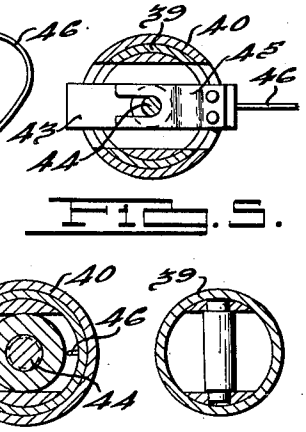


Fig. 5.



Fig. 6. Fig. 7.

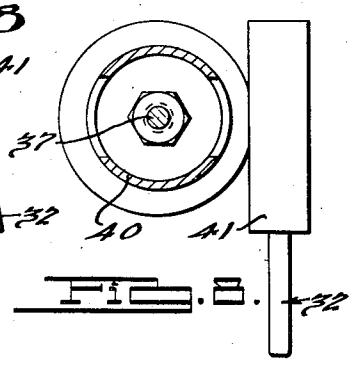


Fig. 8.

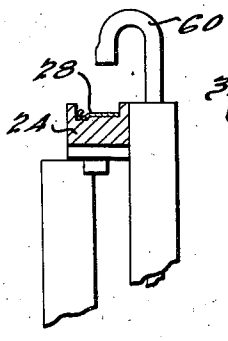


Fig. 9.

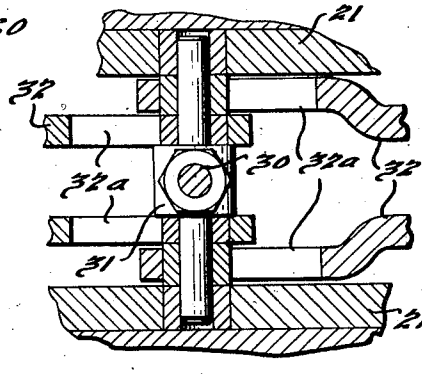


Fig. 10.

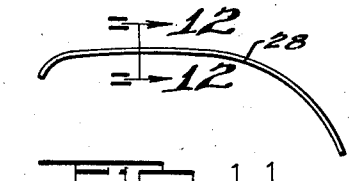


Fig. 11.

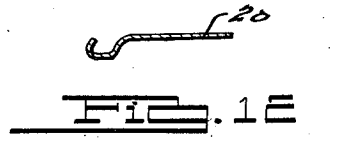


Fig. 12.

INVENTOR
George W. Drysdale.
BY Dike, Calver & Gray
ATTORNEYS.

Patented Dec. 22, 1942

2,305,850

# UNITED STATES PATENT OFFICE

2,305,850

## BENDING MACHINE

George W. Drysdale, Detroit, Mich., assignor to Briggs Manufacturing Company, Detroit, Mich., a corporation of Michigan

Application May 27, 1940, Serial No. 337,390

28 Claims. (Cl. 153—46)

This invention relates to bending machines and more particularly to such machines adapted for bending relatively long workpieces to shapes of three-dimensional curvature.

One of the objects of the present invention is to provide an improved bending machine capable of bending relatively long workpieces such as various moldings and the like to shapes of three-dimensional curvature.

Another object of the invention is to provide a bending machine which includes improved pneumatically operated means for maintaining the pressure shoe in contact with the workpiece as well as for moving said shoe along the workpiece for bending the same.

A further object of the invention is to provide an improved bending machine for bending relatively long workpieces, which machine extends vertically in one of its larger dimensions and therefore occupies relatively small floor space.

A still further object of the invention is to provide an improved bending machine having interchangeable track structure and capable of being adapted for bending various workpieces simply by installing therein a corresponding track portion and without reconstructing other operative parts of the machine.

A still further object of the invention is to provide an improved pneumatically operated bending machine which is controlled in an improved and simplified manner.

It is an added object of the present invention to provide an improved bending machine which is compact and simple in its construction, safe and dependable in operation and relatively inexpensive to manufacture.

Other objects and advantages of this invention will appear in the following description and appended claims, reference being had to the accompanying drawings forming a part of this specification, wherein like reference characters designate corresponding parts in the several views.

Fig. 1 is a front view of a bending machine embodying the present invention, the operating cylinders of the machine being shown broken to expose the pistons slidably fitted therein.

Fig. 2 is a rear view of the machine of Fig. 1, one leg of the standard supporting the power cylinder being broken away in order to show the connection between the power cylinder piston rod and the bell cranks.

Fig. 3 is a fragmentary sectional view taken in the direction of the arrows on the section plane passing through the line 3—3 of Fig. 1, said view showing the articulated outer end of one bell crank carrying the pressure cylinder.

Fig. 4 is a fragmentary sectional view taken in the direction of the arrows on the section plane passing through the line 4—4 of Fig. 3.

Figs. 5, 6, 7 and 8 are sectional views taken in the direction of the arrows on the section planes passing through the lines 5—5, 6—6, 7—7 and 8—8 of Fig. 4, respectively.

Fig. 9 is a sectional view illustrating the locking means and showing the track structure in section, the view being taken in the direction of the arrows on the section plane passing through line 9—9 of Fig. 1.

Fig. 10 is a transverse sectional view through the power cylinder supporting standard, said view being taken in the direction of the arrows on the section plane passing through the line 10—10 of Fig. 1.

Fig. 11 illustrates the workpiece in its finished form.

Fig 12 is a transverse sectional view of the workpiece, said view being taken in the direction of the arrows on the section plane passing through the line 12—12 of Fig. 11.

Before explaining in detail the present invention it is to be understood that the invention is not limited in its application to the details of construction and arrangement of parts illustrated in the accompanying drawings, since the invention is capable of other embodiments and of being practiced or carried out in various ways. Also it is to be understood that the phraseology or terminology employed herein is for the purpose of description and not of limitation, and it is not intended to limit the invention claimed herein beyond the requirements of the prior art.

In the drawings there is shown, by way of example, a bending machine embodying the present invention. The machine illustrated in the drawings and hereinafter described is constructed for bending a workpiece which is a piece of molding employed in construction of automobile bodies, such for instance as a drip molding having in its finished shape a longitudinal curvature of three-dimensional type, or in other words bent in three directions. For the sake of clarity it may be mentioned that relatively long workpieces bent to three-dimensional curvature cannot lie flat on a straight plane.

It will be understood that bending machines constructed in accordance with the present invention may be successfully used for bending other relatively long workpieces and it will be only necessary to substitute the track structure

to adapt the machine to bend another workpiece. Other operative parts of the machine are so constructed that change of the track can be easily effected and operation of the machine is effective for a wide range of curvatures of workpieces.

The machine herein illustrated and described is pneumatically operated, which is to say, is actuated by compressed air. It will be understood, however, that machines constructed in accordance with the present invention may be successfully operated by fluids in states other than gaseous, such for instance as by liquid fluids. In other words they may be operated hydraulically as well.

The bending machine illustrated in the drawings and hereinafter described in detail comprises generally a base supporting an upstanding power cylinder, which cylinder in turn supports a track structure adapted to receive a workpiece. The power cylinder is provided with a piston actuating two bell cranks carrying fluid actuated pressure means on their ends, said pressure means adapted to follow a groove provided in the track structure thereby bending the workpiece.

Referring particularly to the drawings, the bending machine illustrated therein comprises a base plate 20 on which there is mounted an upstanding standard 21 formed by two legs connected at their tops by a plate 22. The plate 22 supports a vertically arranged power cylinder 23 which, in turn, supports at its top a track rail 24 bent to desired curvature, in the present case of three-dimensional character, the ends of said rail 24 being fixed to the base plate 20 as shown at 25 and 26. The track rail 24 is provided with a suitable groove 27 adapted to receive a workpiece 28, in the present instance a drip molding for an automobile body.

Within the power cylinder 23 there is slidably fitted a piston 29 to which there is connected in a conventional manner a piston rod 30. The opposite end of the piston rod carries a cross head 31 engaging the slots 32*a* provided in the inner ends of bell cranks 32. The bell cranks are hinged by their middle portions as shown at 33 in brackets 34 secured to the base plate 20.

It will now be understood in view of the foregoing that as the piston 29 moves downwardly, the cross head 31 exerts pressure on the inner ends of the bell cranks 32 pushing the same downwardly, in consequence whereof the outer ends of the bell cranks 32 move upwardly, swinging toward the power cylinder 23.

The bell cranks 32 carry on their outer portions or arms pressure cylinders generally indicated by numerals 35. Within each of said pressure cylinders there is slidably fitted a piston 36 having a piston rod 37 extending outwardly through the cylinder cover 38 and carrying at its outer end a recessed cylinder or hollow piston 39 adapted to slide in a guide sleeve 40 secured to a swinging bracket 41 hinged at 42 to the outer arm of the respective bell crank. The hinge 42 being perpendicular to the hinge 33, the bracket 41 is thus adapted to move in a plane perpendicular to the plane in which the bell crank 32 is adapted to rotate, and therefore a pressure shoe 43 connected to the outer end of the recessed cylinder 39, as is best shown in Fig. 4, may follow the three-dimensional curvature of the forming groove 27. Thus the connection of the pressure shoe and the bell crank carrying the same is in the nature of a universal connection permitting the shoe to follow practically any given curvature of the track. Radial movements of the pressure shoe 43, which is to say, movements thereof toward and away from the hinge 33, are permitted by sliding of the shoe together with the piston 36 in said directions. Swinging movements of the shoe 43 around said hinge 33 as a center are permitted due to the hinging of the arms at said hinges 33, while movements of the shoe 43, together with the pressure cylinder 35, in planes perpendicular to the planes in which the arms 32 are adapted to swing, are permitted by the provision of the hinges 42. As shown in Fig. 4, the pressure shoe 43 is loosely connected to a screw 44 secured to the closed end of the cylinder 39 and adapted to transmit working pressure to said shoe. The shoe 43 is held to the round head 44*a* of the screw 44 by springs 45 and 46 and is permitted to rotate and to rock around said head within predetermined limits. The rail 24 of the track structure passes through the registering recesses of both cylinder 39 and guide sleeve 40.

When fluid under pressure is admitted into the outward or upper portions of the pressure cylinders 35, pistons 36 are moved downwardly together with the recessed cylinders 39 rigidly secured to said pistons. By virtue thereof, the screws 44 bring the pressure shoes 43 into the forming groove 27 by exerting pressure on the track rail in proportion to the fluid pressure in the cylinders 35. When under such conditions fluid under pressure is admitted to the power cylinder 23 the pressure shoes 43 are moved along the forming groove 27 exerting bending pressure thereon.

In the present instance the machine is pneumatically operated and is provided with a plurality of air conduits delivering air under pressure into the power and pressure cylinders. The conduits are controlled by means of a plurality of manually operated valves with the aid of which air under pressure is admitted into the cylinders on the proper side of the pistons depending upon the conditions. The control valve 47 having a manually operated handle 47*a* is adapted to admit air under pressure into the upper portion of the cylinder 23 through the conduit 48 and to the lower side of said cylinder through the conduit 49, providing at the same time an exhaust opening for the air on the opposite side of the piston. Thus when the handle 47*a* is moved into the position to exert downward movement of the piston 29 air under pressure is admitted through the conduit or pipe 48 and at the same time the air entrapped on the lower side of the piston 29 is permitted to escape into the open air. For upward movement of the piston, the handle 27*a* is moved into the position to admit air under pressure through the pipe 49 and to permit escape of the air above the piston 29 into the atmosphere.

The valve 50 is adapted to control the pressure cylinders 35 through conduits 51 and 52. For exerting working pressure on the pressure shoes 43 the control handle 50*a* is moved into the position to admit air under pressure through flexible conduits 51 and to permit the escape of air entrapped under the pistons. For releasing the pressure on the shoes 43 and raising the same from the track air under pressure is admitted through the conduits 52 while the air in the outward or upper portions of the cylinders is permitted to escape into the atmosphere. A safety valve 50*b* is provided on one of the cylinders and it serves both of them because of the connection between said cylinders.

In operation, the outer arms of the bell cranks 32 together with the pressure shoes and their operating mechanisms are brought toward the power cylinder 23 by moving the piston 29 thereof downward. Thereupon a workpiece is inserted through the recesses of the cylinders 39 and sleeves 40 of both bell cranks from the right-hand side in Fig. 1 until the end of the workpiece abuts against the stop plate 53 carried by a bar 54 adjustably secured to the track structure as illustrated at 55. Thereupon by operating pedals 56 of a control valve 57 air under pressure is admitted into the upper portion of a cylinder 58 moving its piston 59 downwardly and thereby locking the workpiece in the forming groove 27 by means of a locking hook 60 (see Figs. 1 and 9). The machine is now ready for operation. By admitting air through the pipe 49, the piston 29 is moved upwardly swinging the bell cranks outwardly, whereby the pressure shoes 43 move over the workpiece forcing the same into the forming groove 27 along the entire length thereof, thus bending the workpiece into the form of the forming groove 27. The workpiece and the pressure shoe are preferably amply lubricated during the bending operation. After the completion of the bending operation, the pressure is relieved in cylinders 35 in the way described above, and the outer arms of the bell cranks are moved toward the cylinder as described above. By manipulating pedals 56 air is admitted into the lower portion of the cylinder 58 through a conduit 61, while the air from the upper portion of said cylinder is adapted to escape through the upper conduit 62, whereby the workpiece is unlocked and removable from the groove.

For adapting the above described machine for bending various workpieces to desired curvature it is only necessary to change the track structure 24. The relatively long recesses of the cylinders 39 and guide sleeves 40 permit use of the machine for bending workpieces having curvatures of various kinds and of considerable departure from circular shape. Since during the entire operation the pressure within the pressure cylinders 35 remains substantially constant, the working pressure on the workpiece is also constant, and therefore the appearance of the bent piece is even and smooth and the bending operation proceeds smoothly and without undesirable jerks and stiffness in places.

I claim:

1. In a bending machine, a rigid track structure adapted to receive a workpiece to be bent, said track structure being arranged in a substantially vertical plane, a power cylinder arranged under said track and having a piston slidably fitted therein, a bell crank hinged intermediate its ends on a support rigid with respect to said track and having one end connected to said piston, a cylinder secured to the other end of said bell crank and having a fluid actuated piston slidably fitted in said cylinder, and a pressure shoe connected to said fluid actuated piston for maintaining in operation yielding pressure contact with the workpiece.

2. In a bending machine, a rigid track structure adapted to receive a workpiece to be bent, a power cylinder arranged under said track and having a piston slidably fitted therein, a bell crank having an intermediate portion hinged to a rigid support and having two arms, one of said arms being connected to said piston, a second cylinder with a fluid actuated piston carried by the other arm of said bell crank, a pressure shoe connected to the piston of said second cylinder and adapted to follow the configuration of said track structure for bending the workpiece by application of yielding pressure thereon.

3. In a bending machine, a base, a curved track structure supported above the base and having an upwardly facing track adapted to receive a workpiece to be bent, fluid pressure means supported from the base and arranged beneath the track and swingable in the general plane of the track, and pressure means engageable with the workpiece and adapted to be drawn down by said fluid pressure means upon the track to bend the workpiece as said fluid pressure means is swung relatively to the track, and power means arranged beneath the track and adapted to swing said pressure means.

4. In a bending machine, a base, a curved track structure supported above the base and having an upwardly facing track adapted to receive a workpiece to be bent, fluid pressure means supported from the base and arranged beneath the track and swingable in the general plane of the track, pressure means engageable with the workpiece and adapted to be drawn down by said fluid pressure means upon the track to bend the workpiece as said fluid pressure means is swung relatively to the track, and fluid power means arranged beneath the track for swinging said fluid pressure means.

5. In a bending machine, a rigid curved track structure having a track along one side to receive a workpiece to be bent, a swinging arm pivotally supported at the opposite side of the track, a pressure shoe at said first mentioned side of the track adapted to contact the workpiece to bend the same, and fluid actuated means carried by the arm at said opposite side of the track and having an operative connection with the shoe, said track structure extending through said connection, and power means arranged within the confines of said track structure and adapted to actuate said swinging arm.

6. In a bending machine, a rigid curved track structure having a track along one side to receive a workpiece to be bent, a swinging arm pivotally supported at the opposite side of the track, a pressure shoe adapted to contact the workpiece to bend the same, and fluid actuated means carried by the arm and having an operative connection with the shoe, said connection including a slotted member embracing said track structure and movable transversely of the track during swinging movement of the arm, and power means arranged within the confines of said track at said opposite side thereof and adapted to actuate said swinging arm.

7. In a bending machine, a rigid curved track structure having a track along one side to receive a workpiece to be bent, a swinging arm pivotally supported at the opposite side of the track, a pressure shoe adapted to contact the workpiece to bend the same, fluid actuated means carried by the arm and having an operative connection with the shoe, said connection including a slotted member embracing said track structure and movable transversely of the track during swinging movement of the arm, and fluid power means for swinging said arm, said power means being arranged within the confines of said track structure at said opposite side thereof.

8. In a bending machine, a rigid curved track adapted to receive a workpiece to be bent, a fluid pressure cylinder having a reciprocable

piston and supported to swing in two angularly related directions, a pressure shoe adapted to contact the workpiece to bend the same on said track, an operative connection between said piston and shoe including a member embracing the track and shiftable transversely relatively thereto, and fluid power means for swinging said cylinder and arranged substantially within the confines of the track.

9. In a bending machine, a rigid curved track adapted to receive a workpiece to be bent, a fluid pressure cylinder having a reciprocable piston and supported to swing generally in the plane of the track, a pressure shoe adapted to contact the workpiece to bend the same on said track, an operative connection between said piston and shoe including a member embracing the track and shiftable transversely relatively to the plane of the track, and fluid power means for swinging said cylinder and arranged substantially within the confines of the track.

10. In a bending machine, a rigid track structure having a forming groove adapted to receive a workpiece to be bent, a power cylinder having a piston slidably fitted therein, a bell crank having an intermediate portion hinged to a rigid support and having two arms, one of said arms being connected to said piston, a second cylinder with a fluid actuated piston carried by the other arm of said bell crank, a pressure shoe carried by the piston of said second cylinder and adapted to follow the configuration of said groove for bending the workpiece, the hinge connection of said fluid actuated piston and said arm of the bell crank being of a character to effect three-dimensional travel of the pressure shoe carried by said piston.

11. In a bending machine, a rigid track structure having a forming groove adapted to receive a workpiece to be bent, a power cylinder arranged under said track and having a piston slidably fitted therein, a bell crank having an intermediate portion hinged to a support for rotating substantially within the plane of said track and provided with two arms, one of said arms being drivingly connected to said piston, a second cylinder having a fluid actuated piston, hinge means connecting said second cylinder to the other arm to travel transversely of the plane of said track, and a pressure shoe operatively connected to the piston of said second cylinder.

12. In a bending machine, a track structure having a forming groove adapted to receive a workpiece for bending the same to three-dimensional curvature, an upstanding power cylinder supporting said track structure, a pneumatically actuated piston slidably fitted in said cylinder, a piston rod secured to said piston and extending downwardly and away from said track structure, two bell cranks connected to said piston rod and actuated thereby, and two pressure shoes carried by said bell cranks and adapted to slide along the forming groove.

13. In a bending machine, a forming track adapted to receive a workpiece to be bent, two bell cranks each having an intermediate portion and two arms laterally extending therefrom, said bell cranks being hinged at said intermediate portions to a rigid support to travel substantially in the plane of said track, a cylinder with a fluid operated piston slidably fitted therein, said cylinder being arranged under said forming track, means drivingly connecting said piston with the adjacent arms of said bell cranks, two pressure shoes adapted to follow the configuration of said track for bending the workpiece, and fluid operated yielding means connecting said pressure shoes to the free arms of said bell cranks respectively and adapted to maintain pressure contact between said shoes and the workpiece as said shoes are moved along the track.

14. In a bending machine, a forming track arranged substantially in a vertical plane adapted to receive a workpiece to be bent, two bell cranks each having an intermediate portion and two arms extending therefrom, said bell cranks being hinged at said intermediate portions to a rigid support to travel substantially in the plane of said track, a cylinder with a fluid operated piston slidably fitted therein, said cylinder being arranged in an upstanding position under said forming track, means drivingly connecting said piston with the adjacent arms of said bell cranks, two pressure shoes adapted to follow the configuration of said track for bending the workpiece, and pneumatic means connecting said pressure shoes to the free arms of said bell cranks respectively and adapted to maintain pressure contact between said shoes and the workpiece as said shoes are moved along the track.

15. A bending machine comprising an upright standard, a cylinder mounted on said standard and having a fluid actuated piston slidably fitted therein, a piston rod secured to said piston and extending downwardly, a track intermediately supported by said cylinder and adapted to receive a workpiece for bending the same, a bell crank having one end drivingly connected to said piston rod, a cylinder carried by the other end of said bell crank and having a fluid actuated piston slidably fitted therein, a pressure shoe adapted to follow said track and connected to said piston for producing bending pressure on the workpiece.

16. A bending machine comprising an upright standard, a cylinder mounted on said standard and having a fluid actuated piston slidably fitted therein, a piston rod secured to said piston and extending downwardly, a track supported by said cylinder and adapted to receive a workpiece for bending the same, a bell crank having one end drivingly connected to said piston rod, a cylinder carried by the other end of said bell crank and having a fluid actuated piston slidably fitted therein, a pressure shoe adapted to follow said track and connected to said piston for producing bending pressure on the workpiece, and manually operable means for controlling fluid pressure in said cylinders.

17. A bending machine comprising an upright standard, a cylinder mounted on said standard and having a fluid actuated piston slidably fitted therein, a piston rod secured to said piston and extending downwardly, a track supported by said cylinder and adapted to receive a workpiece for bending the same, a bell crank having one end drivingly connected to said piston rod, a cylinder carried by the other end of said bell crank and having a fluid actuated piston slidably fitted therein, a pressure shoe adapted to follow said track and connected to said piston for producing bending pressure on the workpiece, and means for controlling fluid pressure in said cylinders, said means being separably controllable for each of said cylinders.

18. A bending machine comprising an upright standard, a cylinder mounted on said standard and having a fluid actuated piston slidably fitted therein, a piston rod secured to said piston and extending downwardly, a track supported by said cylinder and adapted to receive a workpiece for

bending the same, a bell crank having one end drivingly connected to said piston rod, a cylinder carried by the other end of said bell crank and having a fluid actuated piston slidably fitted therein, a pressure shoe adapted to follow said track and connected to said piston for producing bending pressure on the workpiece, manually operable means for controlling fluid pressure in said cylinders, said means being separably controllable for each of said cylinders, and fluid actuated means mounted on said track adjacent said cylinder for locking the workpiece to said track.

19. A bending machine comprising an upright standard, a power cylinder mounted on said standard and having a fluid actuated piston slidably fitted therein, a piston rod secured to said piston and extending downwardly, a substantially rigid track structure supported between its ends by said power cylinder and having a track groove adapted to receive a workpiece for bending the same, two bell cranks operatively mounted on both sides of said standard and having their inner ends drivingly secured to said piston rod, two pressure cylinders carried by the outer ends of said bell cranks, said cylinders having fluid actuated pistons slidably fitted therein, two pressure shoes connected to said pistons to exert bending pressure on the workpiece for bending the same, said pressure shoes being movable along the track by said bell cranks.

20. A bending machine comprising an upright standard, a power cylinder mounted on said standard and having a fluid actuated piston slidably fitted therein, a piston rod secured to said piston and extending downwardly, a substantially rigid track structure supported by said power cylinder and having a track groove of three-dimensional curvature and adapted to receive a workpiece for bending the same to such curvature, two bell cranks operatively mounted on both sides of said standard and having their inner ends drivingly secured to said piston rod, two pressure cylinders carried by the outer ends of said bell cranks, said outer ends being of articulated construction to permit movement of said cylinders perpendicularly to the plane of rotation of the bell cranks, said cylinders having fluid actuated pistons slidably fitted therein, two pressure shoes connected to said pistons to exert bending pressure on the workpiece for bending the same, said pressure shoes being movable along the track by said bell cranks.

21. A bending machine comprising an upright standard, a power cylinder mounted on said standard and having a fluid actuated piston slidably fitted therein, a piston rod secured to said piston and extending downwardly, a substantially rigid track structure supported by said power cylinder and having a track groove adapted to receive a workpiece for bending the same, two bell cranks operatively mounted on both sides of said standard and having their inner ends drivingly secured to said piston rod, two pressure cylinders carried by the outer ends of said bell cranks, said cylinders having fluid actuated pistons slidably fitted therein, two pressure shoes connected to said pistons to exert bending pressure on the workpiece for bending the same, said pressure shoes being movable along the track by said bell cranks, a plurality of fluid conveying conduits operatively connected to said cylinders, and means controlling said conduits, said means being separably controllable for said power cylinder and for said pressure cylinders.

22. A bending machine comprising an upright standard, a power cylinder having a fluid actuated piston slidably fitted therein, a piston rod secured to said piston and extending downwardly, a substantially rigid track structure supported by said power cylinder and having a track groove adapted to receive a workpiece for bending the same, two bell cranks operatively mounted on both sides of said standard and having their inner ends drivingly secured to said piston rod, two pressure cylinders carried by the outer ends of said bell cranks, said cylinders having fluid actuated pistons slidably fitted therein, two pressure shoes connected to said pistons to exert bending pressure on the workpiece for bending the same, said pressure shoes being movable along the track by said bell cranks, a plurality of fluid intake and exhaust conduits operatively connecting said cylinders with a source of fluid under pressure and exhaust ports, and a corresponding plurality of manually operable valves for controlling said conduit and consequently the operative pressure in said cylinders.

23. A bending machine comprising an upright standard, a power cylinder mounted on said standard and having a fluid actuated piston slidably fitted therein, a piston rod secured to said piston and extending downwardly, a substantially rigid track structure supported by said power cylinder and having a track groove adapted to receive a workpiece for bending the same, two bell cranks operatively mounted on both sides of said standard and having their inner ends drivingly secured to said piston rod, two pressure cylinders carried by the outer ends of said bell cranks, said cylinders having fluid actuated pistons slidably fitted therein, two pressure shoes connected to said pistons to exert bending pressure on the workpiece for bending the same, said pressure shoes being movable along the track by said bell cranks, a plurality of fluid conveying conduits operatively connected to said cylinders, and means controlling said conduits, said means being separably controllable for said power cylinder and for said pressure cylinders, and fluid actuated means for locking the workpiece substantially at its middle portion to said track.

24. In a bending machine, a vertically arranged power cylinder having a fluid operated piston slidably fitted therein, said piston being adapted to produce the workpiece bending forces, and a rigid curved track structure supported intermediate its ends by the body of said cylinder and arranged in a substantially vertical plane passing through said cylinder.

25. In a bending machine, a flat base adapted to rest directly on the floor, a vertically arranged power cylinder supported on said base and having a piston slidably fitted therein and adapted to produce workpiece bending forces, a rigid curved track structure having two ends supported on said flat base and a middle portion supported by the body of said cylinder, said track structure being arranged in a substantially vertical plane passing through the body of said cylinder.

26. In a bending machine, a base, a vertically arranged curved upwardly facing track extending above the base with the ends of the track extending downwardly and having connections with the base, pressure means at the outer side of the track operable against a workpiece on said track, and power means at the opposite side of the track between said track connections for drawing down said pressure means to bend the workpiece as said pressure means is moved along the curved path of the track.

27. In a bending machine, a base, a vertically arranged curved upwardly facing track extending above the base with the ends of the track extending downwardly and having connections with the base, pressure means at the outer side of the track operable against a workpiece on said track, power means at the opposite side of the track between said track connections for drawing down said pressure means to bend the workpiece as said pressure means is moved along the curved path of the track, and power means beneath said track for shifting said pressure means along said path.

28. In a bending machine, a base, a vertically arranged curved upwardly facing track extending above the base with the ends of the track extending downwardly and having connections with the base, pressure means at the outer side of the track operable against a workpiece on said track, and power mechanism arranged at the opposite side of the track between said track connections for drawing down said pressure means yieldingly against the track and also for moving the pressure means along the track to bend the workpiece.

GEORGE W. DRYSDALE.